SAE Aero Design

Problem Definition and Project Plan

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Introduction

- The SAE Aero Design event can be categorized into three classes of competition: Regular, Advanced and Micro. The team will be competing in the Regular Aero design competition
- The Regular class features collegiate teams from across the country competing with the purpose of understanding flight
- The SAE Aero Design challenge gives undergraduate engineering students a chance to complete objectives for a design while competing and having fun
- The rules are developed which will focus on educational values and real experimental experience. The rules will also have strong relationships with advancing technology

Need Statement

Northern Arizona University does not have an airplane design to compete in the SAE Aero design competition, so the team is tasked with the design and construction of the airplane.

Project Goals

- Design and build an aircraft that adheres to the SAE Aero competition requirements
- Gain valuable knowledge in the mechanical engineering design and manufacturing processes, specifically in airplane design
- Compile an excellent report detailing the design and manufacturing processes and orally present the final design
- Win the SAE Aero Regular class competition

Objectives

Objective	Measurement	Units of Measurement
Carry max payload	Weight	Pounds Force (lbf)
Carry a payload from point A to B	Distance	Feet (ft)
Small turning radius	Distance	Feet (ft)

Constraints

- Freestanding aircraft must not exceed a combined length, width and height of 175 inches
- Aircraft must be powered by a commercially available lithium-polymer battery pack
- Must use a new 2015 version 1000 watt power limiter provided by Neumotors.com
- Interior payload bay must be smooth and dimensions must be 10"x4" x4" (length, width, height) with a tolerance of +0.125, -0.000

Constraints

- Payload must be secured to an airframe, with payload plates
- Airplane must land and take off within 200 ft
- Must complete all tasks within 180 seconds

Quality Function Deployment

Regular Class Design Requirements	Weight s	Size	Safety	Material	Motor	Gear Box	Battery	Radio System	Interior Dimensi on
AIRCRAFT DIMENSION REQUIREMENT	5	9	1	0	0	1	0	0	9
MATERIAL AND EQUIPMENT RESTRICTIONS FOR REGULAR CLASS	5	3	9	9	9	1	3	3	1
AIRCRAFT SYSTEM REQUIREMENTS	5	3	9	3	9	1	9	9	0
PAYLOAD REQUIREMENTS	5	3	3	9	3	1	3	0	9
	Raw score	90	110	105	105	20	75	60	95
	Scaled	1	1	1	1	1	1	1	1
	Relative Weight	14%	17%	16%	16%	3%	11%	9%	14%
	Rank	5	1	2	2	8	6	7	4



Project Plan

Task	W1	W 2	W 3	W 4	W 5	W 6	W7	W 8	W 9	W 10	W 11	W 12	W 13	W 14	W 15
Client meeting															
Define problem and layout project plan															
Research design															
Research protocol writing															
Data collection															
Select a sample															
Pick a final design (decision matrix)															
Finalize design															
Problem Definition and Project Plan Presentations				#											
Concept Generation and Selection Presentations								#							
Proof of Concept Demonstrations												#			
Project Proposal Presentations															#

State of the Art Research

- · 3D printing
- · Innovative filaments
 - · ABS/PLA
 - Ninjaflex Filament
 - Metal fill (80% metal 20% plastic)
 - Carbon Fiber / Fiberglass
- · 3D slicing software
 - Simplify3d





State of the Art Research

- Computer Aided Design
 - Most current software (2016 versions)
 - Autodesk products
 - Inventor 2016
 - Fusion 360
 - · CFD







Source: www.autodesk.com

State of the Art Research

- Airplane components
 - Propellers
 - Variable Pitch Prop
 - maximize torque / power

Conclusions

- The aircraft must take of with a payload, complete a 360 degree circuit and land
- Adheres to the SAE Aero competition requirements
- Constraints include a maximum combined dimensions of 175 inches, specific bay area volume, and must have a 1000 watt power limiter
- Implementation of cutting edge design software
- 14 week period to complete the design

References

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